

## Preoperative mortality in aortic stenosis

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*Of 135 patients investigated for severe aortic stenosis, 16 died while awaiting surgery. The catheterization data on these patients were compared with those on 55 patients who underwent surgery and were long-term survivors and 42 who died at operation or during the early postoperative period.*

*Of the 16 patients who died before operation, 15 had evidence of left ventricular failure. In addition, the pulmonary artery wedge and the left ventricular end-diastolic pressures were significantly higher than in patients reaching surgery. The patients who were not long-term surgical survivors waited an average period of 5.8 months between cardiac catheterization and operation, during which period left ventricular function may have deteriorated. There was no significant difference in transvalvar pressure gradients. These findings suggest that in severe aortic stenosis, catheterization evidence of left ventricular failure is an indication for urgent surgery.*

Though the risk of sudden death and the grave significance of left ventricular failure in aortic stenosis are well known, the death of several patients while awaiting operation prompted a review of all the adult patients with this condition who have been catheterized in this department between 1964 and 1971.

### Patients

Altogether 135 patients in whom the main lesion was aortic stenosis had been studied. In most of them the transvalvar gradient had been measured by either left ventricular puncture or retrograde aortic catheterization, and the pulmonary artery wedge pressure recorded at rest and on exercise. One hundred and thirteen patients were advised to have aortic valve replacement; 22 were advised against or declined.

Sixteen patients who were advised surgery died before operation: 12 of these died suddenly, either with syncope or acute left ventricular failure and 4 from chronic heart failure. The manner and time of death is shown in Table 1. Two additional patients died suddenly while awaiting admission for catheterization.

Of the 16 patients who were catheterized, 12 were on the waiting list for aortic valve replacement, 3 were undergoing further medical treatment in the hope of rendering them fit for operation, and 1 had refused operation. All the patients with left ventricular failure were receiving full medical treatment with digoxin and diuretics.

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Necropsies were performed on 11 patients and all were shown to have severely stenosed calcified bicuspid aortic valves. Only one patient had a past history of rheumatic fever but he was found to have a calcified bicuspid valve at necropsy.

### Catheterization data (Table 2)

It can be seen that 11 patients had clear evidence of left ventricular failure as measured by left ventricular end-diastolic pressure or pulmonary artery wedge pressure. Three of the patients with normal or slightly raised left ventricular end-diastolic pressures had clinical signs of right ventricular failure. It is possible that these 3 patients had had higher left-sided pressures before the onset of congestive cardiac failure. The remaining patient with a left ventricular end-diastolic pressure of 7 mmHg had had frequent syncopal attacks which were thought to be due to arrhythmia.

These figures were then compared with those for two groups of patients with severe aortic stenosis who had undergone aortic valve replacement between 1964 and 1971 and who had satisfactory measurements of left heart pressure. One group of 55 patients were long-term survivors of surgery and another group of 42 patients had died at operation or during the early postoperative period. The results are shown in Table 3.

It can be seen that there is no appreciable difference in the mean systolic gradients between the three groups. The patients dying before operation did, however, have significantly higher left ventricular end-diastolic pressures ( $P < 0.02$ ) and pulmonary artery wedge pressures ( $P < 0.05$ ) than the two groups of patients reaching operation.

The mean time interval between catheterization and operation was 4.4 months in the long-term survivors and

TABLE 1 *Details of patients dying before operation*

Case No.	Age (yr)	Sex	Catheter - death interval	Mode of death
1	57	M	Not known	Sudden, on exertion
2	61	M	3 dy	Sudden
3	52	F	10 wk	Heart failure
4	65	M	10 mth	Sudden
5	53	M	15 wk	Acute left ventricular failure
6	66	M	5 wk	Sudden
7	63	M	4 mth	Heart failure
8	51	M	7 wk	Heart failure and terminal arrhythmia
9	53	M	8 wk	Sudden
10	22	M	8 mth	Sudden
11	60	M	8 mth	Sudden
12	68	M	9 dy	Sudden
13	55	M	3 mth	Sudden
14	60	M	2 wk	Sudden
15	57	M	12 wk	Heart failure
16	59	F	6 wk	Sudden

TABLE 2 *Intracardiac pressures of patients dying before operation*

Case No.	Systolic aortic gradient	LV end-diastolic pressure (mmHg)*	Pulmonary artery wedge pressure (mmHg) (mean)*	
		Rest	Rest	Exercise
1	48	7		
2	130	40	15	40
3	122	50		
4	90	No satisfactory recording, but clinical signs of LV failure		
5	60			
6	106			
7	106	15 (CCF)		
8	64	12 (CCF)		
9	44	42	30	
10	100	40	27	40
11	—	—	24	32
12	60	20	20	60
13	80	15 (CCF)		
14	80	40		
15	90	35	32	37
16	100	35	30	50
			12	50

CCF = Congestive cardiac failure.

\* Reference zero: mid-chest.

TABLE 3 *Mean pressures in three groups*

	Died before operation (16)	Survived operation (55)	Died at operation (42)
Mean systolic gradient	85 (SD 26)	83 (SD 26)	78 (SD 32)
Mean end-diastolic pressure	31 (SD 14)	22 (SD 10)	19 (SD 11)
Mean pulmonary artery wedge pressure			
Rest	24 (SD 7)	18 (SD 8)	17 (SD 9)
Exercise	46 (SD 10)	37 (SD 11)	35 (SD 11)

SD Standard deviation.

5.8 months in the patients who died at, or shortly after, operation. Reference to Table 1 shows that 12 of the 16 waiting list deaths occurred within 4 months of catheterization.

### Discussion

Previous authors have shown that while patients with aortic stenosis may survive several years after the onset of syncopal attacks or angina pectoris, the development of left ventricular failure usually led to death within one year (Contratto and Levine, 1937; Oleson and Warburg, 1958). Harken (1955) described 34 patients with aortic stenosis who were advised aortic valve replacement but refused operation. All had evidence of left ventricular failure and 30 died within 6 months of investigation.

Mitchell *et al.* (1954) found a mean survival of 22 months from the onset of symptoms of heart failure in pure aortic stenosis. Takeda, Warren, and Holzman (1963) found a mean survival of 2.8 years but their series was small (42 patients) and excluded those referred for surgery.

The present study suggests, as would be expected, that in severe uncomplicated aortic stenosis the demonstration of a raised left ventricular end-diastolic pressure or pulmonary artery wedge pressure may be more indicative of a poor immediate prognosis than the systolic gradient. In fact, as the left ven-

tricle fails the gradient may fall to levels that would not be regarded as indicating severe stenosis. In such a situation the risk of death within a few months seems to be sufficient to indicate valve replacement with the minimum delay.

Our experience indicates that a waiting period of almost 6 months between catheterization and surgery in patients with evidence of left ventricular failure will inevitably be accompanied by a high mortality before surgery, and that these patients must be regarded as surgical emergencies.

### References

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